Mathematical Modelling and Numerical Analysis 2002 vol.36 N6, pages 1043-1070

Computation of 3D vertex singularities for linear elasticity: Error estimates for a finite element method on graded meshes

Apel T., Sändig A., Solov'ev S.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

This paper is concerned with the computation of 3D vertex singularities of anisotropic elastic fields with Dirichlet boundary conditions, focusing on the derivation of error estimates for a finite element method on graded meshes. The singularities are described by eigenpairs of a corresponding operator pencil on spherical polygonal domains. The main idea is to introduce a modified quadratic variational boundary eigenvalue problem which consists of two self-adjoint, positive definite sesquilinear forms and a skew-Hermitean form. This eigenvalue problem is discretized by a finite element method on graded meshes. Based on regularity results for the eigensolutions estimates for the finite element error are derived both for the eigenvalues and the eigensolutions. Finally, some numerical results are presented.

http://dx.doi.org/10.1051/m2an:2003005

Keywords

3D vertex singularities, Error estimates, Finite element methods, Linear elasticity, Quadratic eigenvalue problems